Planning Division
Environmental Branch

Mr. James J. Slack
U.S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960-3559

Dear Mr. Slack:

The U.S. Army Corps of Engineers (Corps), Jacksonville District proposes to conduct a feasibility study to assess Federal interest in navigation improvements throughout the Port of Miami, Miami-Dade County, Florida. An evaluation of benefits, costs, and environmental impacts determines Federal interest.

The recommended plan includes five components: (1) flaring the existing 500-foot wide entrance channel to provide an 800-foot wide entrance channel at Buoy 1, and deepening the entrance channel and widener from an existing depth of 44 feet to a depth of 52 feet; (2) widening the southern intersection of Cut-3 with Lummus Island (Fisherman's) Channel at Buoy 15, and deepening from existing depth of 42 feet to 50 feet; (3) extending the existing Fisher Island turning basin to the north by approximately 300 feet near the west end of Cut-3, and deepening from 43 to 50 feet; (4) relocating the west end of the main channel to about 250 feet to the south (without dredging); and (5) increasing the width of Lummus Island Cut (Fisherman's Channel) about 100 feet to the south of the existing channel, reducing the existing size of the Lummus Island (or Middle) turning basin to a diameter of 1,500 feet, and deepening from the existing 42-foot depth to 50 feet. Additional activities will include mitigation for unavoidable environmental impacts.

Enclosed please find the Corps' Biological Assessment (BA) of the effects of the project as currently proposed on listed species in the action area. After preparing this BA of the impacts of the proposed project, the Corps has determined that the proposed project may affect, but is not likely to adversely affect the endangered American crocodile (*Crocodylus acutus*) and the endangered Florida manatee (*Trichecus manatus*) and is not likely to adversely designated critical habitat for either species. We request that you concur with this finding.

If you have any questions, please contact Ms. Terri Jordan at 904-899-5195 or terri.l.jordan@saj02.usace.army.mil.

Sincerely,

James C. Duck
Chief, Planning Division

Enclosure

Jordan/CESAJ-PD-EA/3453/
McAdams/CESAJ-PD-EA
Dugger/CESAJ-PD-E
Schwictenberg/CESAJ-DP-C
Strain/CESAJ-PD-P
Duck/CESAJ-PD

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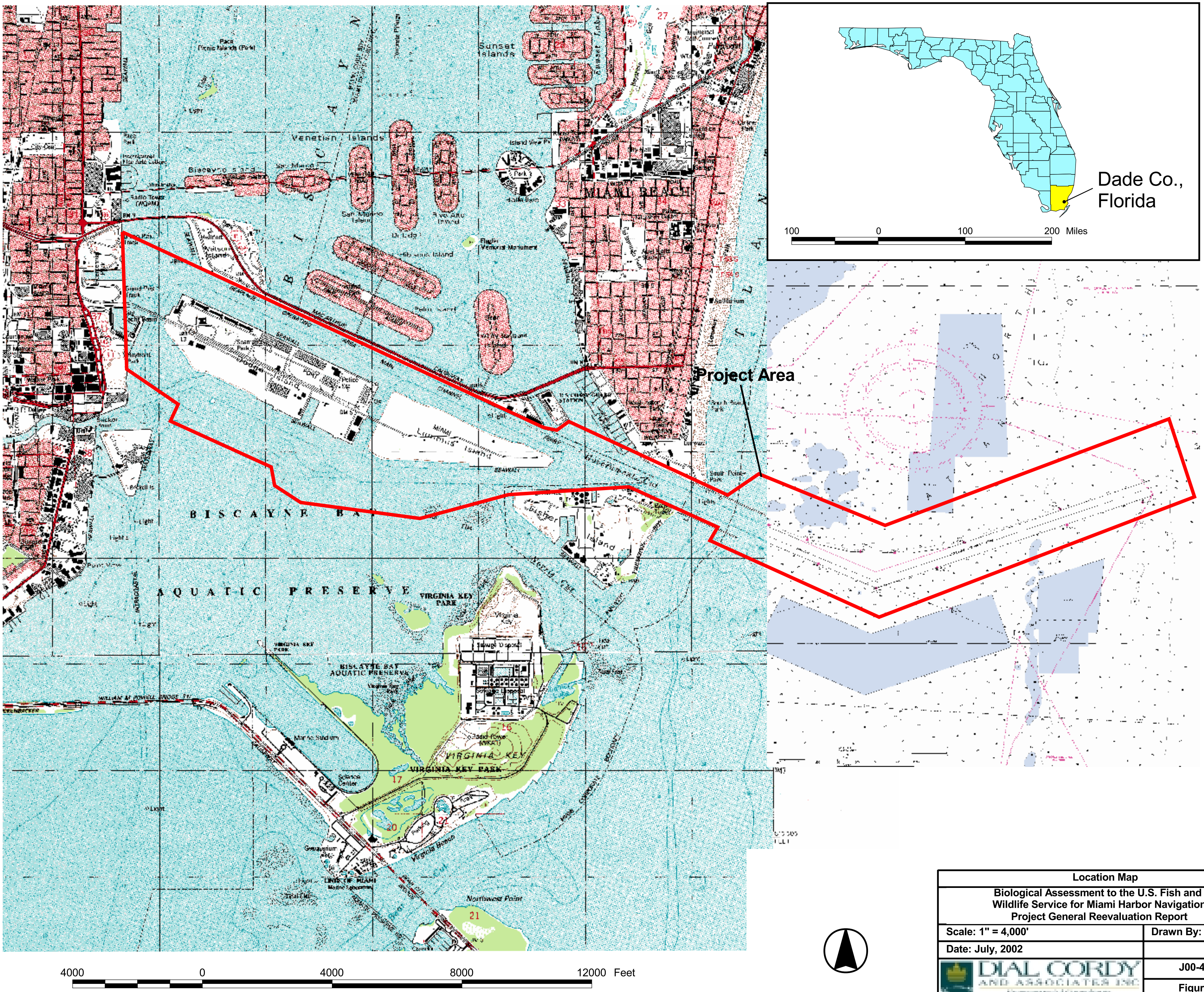
BIOLOGICAL ASSESSMENT TO THE U.S. FISH AND WILDLIFE SERVICE FOR MIAMI HARBOR NAVIGATION PROJECT GENERAL REEVALUATION REPORT

Description of the Proposed Action –

The Port of Miami requested that the U.S. Army Corps of Engineers study the feasibility of widening and deepening most of the major channels and basins within Miami Harbor. A number of alternatives were originally considered, but during efforts to reduce impacts to the environment, many were eliminated from further analysis. Three alternatives were thoroughly analyzed (two action alternatives and the "no action" alternative) in the Environmental Impact Statement. The recommended plan (Alternative 2) includes five components: (1) flaring the existing 500-foot wide entrance channel to provide an 800-foot wide entrance channel at Buoy 1, and deepening the entrance channel and widener from an existing depth of 44 feet to a depth of 52 feet; (2) widening the southern intersection of Cut-3 with Lummus Island (Fisherman's) Channel at Buoy 15, and deepening from existing depth of 42 feet to 50 feet; (3) extending the existing Fisher Island turning basin to the north by approximately 300 feet near the west end of Cut-3, and deepening from 43 to 50 feet; (4) relocating the west end of the main channel to about 250 feet to the south (without dredging); and (5) increasing the width of Lummus Island Cut (Fisherman's Channel) about 100 feet to the south of the existing channel, reducing the existing size of the Lummus Island (or Middle) turning basin to a diameter of 1,500 feet, and deepening from the existing 42-foot depth to 50 feet. The action alternative not selected included these five components and a sixth, involving the deepening of Dodge Island Cut and creation of another turning basin. Sand, silt, clay, soft rock, rock fragments, and loose rock will be removed via traditional dredging methods. Where hard rock is encountered, the Corps anticipates that contractors will utilize other methods, such as blasting, use of a punch-barge/pile driver, or large cutterhead equipment. Blasting will be implemented only in those areas where standard construction methods are unsuccessful. Dredged/broken substrates will be deposited at up to four locations**.** Some rock and coarse materials will be transported by barge and placed at an artificial reef site as mitigation for impacts to hardbottom communities. Other rock/coarse materials will be placed in a previously dredged depression in North Biscayne Bay as part of construction measures to create seagrass habitat. The balance of rock and coarse materials that cannot be utilized will be transported to the Offshore Dredged Materials Disposal Site (ODMDS). Viable sand dredged from inshore areas will be relocated and used as a sand cap for the seagrass mitigation site. The balance of sand will be placed on a permitted, upland disposal area on Virginia Key, for possible future use as beach renourishment material.

Action Area

The Port of Miami (Miami-Dade County, Florida) is one of the major port complexes along the east coast of the U.S. The Port utilizes Miami Harbor, which lies in the north side of Biscayne Bay (Figure 1), a shallow, expansive, subtropical lagoon (thirty-eight miles long, and three to nine miles wide) that extends from the City of North Miami south to the northern end of Key Largo. Average depth is six to ten feet (USACE, 1989). The Bay is bordered on the west by the mainland of peninsular Florida and on the east by both the Atlantic Ocean and a series of barrier



Location Map

Biological Assessment to the U.S. Fish and Wildlife Service for Miami Harbor Navigation Project General Reevaluation Report

Scale: 1" = 4,000'	Drawn By: MR
Date: July, 2002	
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	Figure 1

islands consisting of sand and carbonate deposits over limestone bedrock (Hoffmeister, 1974). Except for Virginia Key, the islands within and adjacent to the project area (Dodge-Lummus, Fisher, Star, Palm, and Claughton Islands, Watson Park, and the barrier island comprising Miami Beach) are completely developed. A mixture of low, medium and high-density residential areas; commercial enterprises; industrial complexes; office parks; and recreational areas characterizes land surrounding the Port of Miami waters. Specific features found to the north of the port's Main Channel include the MacArthur Causeway (Highway A1A), park/recreation and commercial facilities at Watson Island, the Terminal Island industrial area, and the U.S. Coast Guard Base at Causeway Island. Low-density residential uses are found beyond the MacArthur Causeway on Palm, Hibiscus and Star Islands. Medium and high density residential, park/recreation, commercial, and institutional land uses are found to the east of the port on Fisher Island and the southern portion of the City of Miami Beach. Located approximately one-half mile south of the port, across the waters of Biscayne Bay, is Virginia Key. Land uses found on Virginia Key include park/recreation, environmentally protected areas, and institutional and public facilities including the Miami-Dade County Virginia Key Wastewater Treatment Plant. Miami's Central Business District is found to the west of the port. Habitats within the project impact area include seagrass beds; coral reefs and other hardgrounds; sand-, silt-, and rubble-bottom habitats; and rock/rubble habitats. Other habitats in the vicinity of the project include beaches and mangroves. Adjacent to the harbor is the Biscayne Bay Aquatic Preserve, a *No Entry* zone for protection of manatees, and a Critical Wildlife Area associated with Virginia Key.

<u>Protected Species Included in this Assessment</u>

Of the listed and protected species under U.S. Fish and Wildlife Service (FWS) jurisdiction occurring in the action area, the Corps believes that the Florida manatee (*Trichecus manatus*) and the American crocodile (*Crocodylus acutu*s) may be affected by the implementation of the navigation project and are the subject of this document. Protected/listed species that are known to occur in the area and that are under the jurisdiction of the National Marine Fisheries Service (NMFS) include the green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), Hawksbill turtle (*Eretmochelys imbricata*), and smalltooth sawfish (*Pristis pectinata*). The Corps has initiated consultation with the NMFS concerning the effects of the proposed action on these species.

The American crocodile was listed as an endangered species under the Endangered Species Act in 1975 (40 FR 44151) and critical habitat was established for this species in 1979 (44 FR 75076). Populations are at risk due to habitat loss, direct human disturbance, alteration of habitats (including hydrology) by humans, poaching, and incidental takes during net fishing (USFWS, 1992). The American alligator (*Alligator mississippiensis*) is listed under ESA as *threatened by similarity of appearance* in order to better protect American crocodiles. The number of nests observed in surveys has doubled over the last twenty-five years (P. Moler, *in* Richey, 2002). However, population estimates of adults and total individuals range widely, precluding a robust determination of the status of the species within the United States. If current studies determine that natural dispersal, rather than releases by humans, is the cause of recent observations of crocodiles north of Miami-Dade County, the FWS may recommend downlisting the species to "threatened" (Richey, 2002).

The Federal government has recognized the threats to the continued existence of the Florida manatee, a subspecies of the West Indian manatee, for more than 30 years. The West Indian manatee was first listed as an endangered species in 1967 under the Endangered Species Preservation Act of 1966 (16 U.S.C. 668aa(c)) (32 FR 48:4001). The Endangered Species Conservation Act of 1969 (16 U.S.C. 668aa(c)) continued to recognize the West Indian manatee as an endangered species (35 FR 16047), and the West Indian manatee was also among the original species listed as endangered pursuant to the Endangered Species Act of 1973. Critical habitat was designated for the manatee in 1976, and includes the project area (50 CFR 17.95). The justification for listing as endangered included impacts to the population from harvesting for flesh, oil, and skins as well as for sport, loss of coastal feeding grounds from siltation, and the volume of injuries and deaths resulting from collisions with the keels and propellers of powerboats. Manatees are also protected under the provisions of the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 *et seq*.) and have been protected by Florida law since 1892. Florida provided further protection in 1978 by passing the Florida Marine Sanctuary Act designating the state as a manatee sanctuary and providing signage and speed zones in Florida's waterways.

Species and Suitable Habitat Descriptions

American Crocodile *(Crocodylus acutus)*

There are twenty-three species of crocodilians, including eight alligatorid species (alligators and caimans), fourteen crocodylid species, and one gavialid species. Crocodilians occupy portions of all continents with appropriate habitats in the tropics, subtropics, and (for two species) temperate climatic zones. Fifteen species and two subspecies of crocodilians are protected under the Convention on International Trade in Endangered Species (CITES Appendix I).

The historic range of American crocodiles includes the U.S., Mexico, all Central American countries, many Caribbean islands, Venezuela, Colombia, Ecuador, and Peru. In the U.S., they have been observed in Florida Bay and north along coastal areas to Sanibel Island on the west coast of Florida, and north along coastal areas on the east coast to Key Biscayne.

Project Area Distribution

Recent observations have occurred at several localities on Key Biscayne (Crandon Park and Bill Baggs State Recreation Area), as well as scattered records of individual animals in Hollywood (Mazzotti, pers com) and Palm Beach, Florida, and as far north as Jupiter, Florida (Richey, 2002 and FWS, 1999).

Habitats and Habits

The American crocodile is found primarily in mangrove swamps and along low-energy mangrove-lined bays, creeks, and inland swamps (Kushlan and Mazzotti 1989). In Florida, patterns of crocodile habitat use shift seasonally. During the breeding and nesting seasons, adults outside of Key Largo and Turkey Point use the exposed shoreline of Florida Bay. Males tend to stay more inland than the females at this time (FWS, 1999). During the non-nesting season, they are found primarily in the fresh and brackish-water inland swamps, creeks, and bays, retreating further into the backcountry in fall and winter (Kushlan and Mazzotti 1989). In a study by Kushlan and Mazzotti (1989) along northeastern Florida Bay, crocodiles were found in inland ponds and creeks (50 percent of observations), protected coves (25 percent of observations), exposed shorelines (6 percent of observations) and a small number were observed on mud flats. The high use of inland waters suggests crocodiles prefer less saline waters, using sheltered areas such as undercut banks and mangrove snags and roots that are protected from wind and wave action. Access to deep water (>1.0 m) is also an important component of preferred habitats (Mazzoti 1983).

Critical habitat for the American crocodile includes all land and water within an area encompassed by a line beginning at the easternmost tip of Turkey Point, Miami-Dade County, on the coast of Biscayne Bay; southeast along a straight line to Christmas Point at the southernmost tip of Elliott Key; southwest along a line following the shores of the Atlantic Ocean side of Old Rhodes Key, Palo Alto Key, Angelfish Key, Key Largo, Plantation Key, Lower Matecumbe Key, and Long Key, to the westernmost tip of Long Key; northwest along a straight line to the westernmost tip of Middle Cape; north along the shore of the Gulf of Mexico to the north side of the mouth of Little Sable Creek; east along a straight line to the northernmost point of Nine-Mile Pond; northeast along a straight line to the point of beginning (50 CFR 17.95).

The American crocodile is typically active from shortly before sunset to shortly after sunrise (Mazzotti 1983). During these times, crocodiles forage opportunistically; eating whatever animals they can catch. Juveniles typically eat fish, crabs, snakes, and other small invertebrates, whereas adults are known to eat fish, crabs, snakes, turtles, birds, and small mammals (FWS, 1999). American crocodiles probably feed only rarely during periods of low ambient air temperatures, since metabolic and digestive systems are slowed at lower body temperatures.

Females reach sexual maturity at about 2.25 m (Mazzotti 1983), a size reached at an age of about 10 to 13 years. It is not known at what age and size females mature. Similarly, the maximum reproductive age for either sex is not known, although it is known that captively reared crocodilians eventually fail to reproduce. As with most crocodilians, courtship and mating are stimulated by increasing ambient water and air temperatures. Reproductive behaviors peak when body temperatures reach levels necessary to sustain hormonal activity. In South Florida, temperatures sufficient to allow initiation of courtship behavior are reached by late February through March. Like all other crocodilians, the mating system of the American crocodile is polygynous; breeding males may mate with a number of females. Following courtship and mating, females search for and eventually select a nest site in which they deposit an average of about 38 elongated oval eggs. Reported clutch size ranges from 8 to 56 eggs (Kushlan and Mazzotti 1989). Although American crocodile nesting is generally considered a non-social event, communal nesting is the norm in parts of the Caribbean, southeast Cuba, and Haiti. In the U.S., several incidents of 2-clutch nests have been reported (Kushlan and Mazzotti 1989). Nest sites are typically selected where a sandy substrate exists above the normal high water level. Nesting sites include areas of well drained sands, marl, peat, and rocky spoil and may include areas such as sand/shell beaches, stream banks, and canal spoil banks that are adjacent to relatively deep water (Kushlan and Mazzotti 1989). In some instances, where sand or riverbanks are not available for nesting sites, a hole will be dug in a pile of vegetation or marl the female has gathered. The use of mounds or holes for nesting is independent of the substrate type and may vary among years by the same female (Kushlan and Mazzotti 1989). Hatching occurs after approximately 90 days (Britton, 2002). Some parental care has been observed, and it may be critical that parents and hatchlings are left undisturbed by humans as young are emerging from nests with the assistance of adults (FWS, 1992). A complete review of crocodile biology is included in the South Florida Multi-species Recovery Plan (FWS, 1999) and will not be repeated here.

Population Trends
American crocodiles have been reported in South Florida since the arrival of the first non-native settlers. However, many records are anecdotal and many of the observations may have been confused with sympatric alligators. In addition, habitats preferred by crocodiles were remote and inaccessible by early settlers, thereby precluding reliable observations. Early 20th century population estimates of up to 2,000 crocodiles have been published (FWS, 1999), yet this is believed to be an underestimate since hunting and habitat destruction had already occurred by this time. In the late 19th and early 20th centuries many crocodiles were hunted and collected for museums and zoos. The species was also legally hunted in Florida until 1962. By the mid 1970's it is estimated that the population had been reduced to between 100 and 400 animals (Ogden, 1978a *in* FWS, 1999).

Combined, many natural and anthropogenic factors have resulted in adverse effects to the American crocodile. Compared to the historical estimates of 1,000 to 2,000 animals (Ogden, 1978a *in* FWS, 1999), populations have declined, and shifts in the nesting distribution have likely occurred. The lowest estimated population levels apparently occurred sometime during the 1960s or 70s, when Ogden estimated the Florida population of the American crocodile to be between 100 and 400 non-hatchlings.

The American crocodile population in South Florida has increased substantially over the last 20 years. P. Moler (cited in FWS, 1999) believes between 500 and 1,000 individuals (including hatchlings) persist there currently. The recent increase is best represented by changes in nesting effort. Survey data gathered with consistent effort indicate that nesting has increased from about 20 nests in the late 1970s to about 50 nests in 1997. Since female crocodiles produce only one clutch per year, it follows that the population of reproductively active females has more than doubled in the last 20 years. In addition, since at least a portion of the population's sex ratio approaches 1:1, it is likely that the male portion of the population has also increased substantially.

Florida Manatee *(Trichecus manatus)*
All manatees belong to the order Sirenia. The living sirenians consist of one species of dugong and three species of manatee. A fifth species, the Steller's sea cow, was hunted to extinction by 1768. All living sirenians are found in warm tropical and subtropical waters. The West Indian manatee was once abundant throughout the tropical and subtropical western North and South Atlantic and Caribbean waters. The Florida manatee occurs throughout the southeastern United States. However, the only year-round populations of manatees occur throughout the coastal and inland waterways of peninsular Florida and Georgia (Hartman, 1974). During the summer months, manatees may range as far north along the East Coast of the U.S. as Rhode Island, west to Texas, and, rarely, east to the Bahamas (FWS 1996, Lefebvre et al. 1989). There are reports of occasional manatee sightings from Louisiana, southeastern Texas, and the Rio Grande River mouth (Gunter 1941, Lowery 1974).

Distribution
In Florida, manatees are commonly found from the Georgia/Florida border south through Biscayne Bay on the Atlantic coast, and from the Wakulla River south to Cape Sable on the Gulf coast (Hartman 1974, Powell and Rathbun 1984). Manatees are also found in Lake Okeechobee, throughout waterways in the Everglades, and in the Florida Keys. Low numbers of manatees in the Florida Keys has been attributed to the scarcity of fresh water (Beeler and O'Shea 1988).
In warmer months (April to November), the distribution of manatees along the east coast of Florida tends to be greater around the St. Johns River, the Banana and Indian rivers to Jupiter Inlet, and Biscayne Bay. In the winter, higher numbers of manatees are seen on the east coast at the natural warm waters of Blue Spring and near man-made warm water sources on or near the Indian River Lagoon, at Titusville, Vero Beach, Ft. Pierce, Riviera Beach, Port Everglades, Ft. Lauderdale, and throughout Biscayne Bay and nearby rivers and canals (FWS 1996). On the west coast of Florida, larger numbers of manatees are found at the Suwannee, Crystal and Homosassa rivers, Tampa Bay, Charlotte Harbor/Matlacha Pass/San Carlos Bay area, the Caloosahatchee River and Estero Bay area, the Ten Thousand Islands, and the inland waterways of the Everglades. On the west coast, manatee's winter at Crystal River, Homosassa Springs, and other warm mineral springs (Powell and Rathbun 1984, Rathbun *et al.*1990). They also aggregate near industrial warm water outflows in Tampa Bay, the warmer waters of the Caloosahatchee and Orange rivers (from the Ft. Myers power plant), and in inland waters of the Everglades and Ten Thousand Islands. The patchy distribution of manatees throughout all their ranges is due to the distribution of suitable habitat: plentiful aquatic plants and a freshwater source.

Habits
Florida manatees are herbivores that feed opportunistically on a wide variety of submerged, floating and emergent vegetation. Shallow grass beds with ready access to deep channels are the preferred feeding areas in coastal and riverine habitats. Bengtson (1983) estimated that the annual mean consumption rate for manatees feeding in the upper St. John's River at 4% to 9% of their body weight per day depending on season. A complete review of manatee biology is included in the manatee section of the South Florida Multi-species Recovery Plan (FWS, 1999).

Preferred Habitats
Manatees occur in fresh, brackish, and salt water and move freely between environments of salinity extremes. They inhabit rivers, bays, canals, estuaries, and coastal areas that provide seagrasses and macroalgae. Freshwater sources, either natural or human-influenced/created, are especially important for manatees that spend time in estuarine and brackish waters (FWS 1996). Because they prefer water above 70 ºF (21 ºC), they depend on areas with access to natural springs or water effluents warmed by human activities, particularly in areas outside their native range.

Manatees often seek out quiet areas in canals, lagoons or rivers. These areas provide habitat not only for feeding, but also for resting, cavorting, mating, and calving. Manatees may be found in any waterway over 3.3 ft. (1 m) deep and connected to the coast. Deeper inshore channels and nearshore zones are often used as migratory routes (Kinnaird 1983). Although there are reports of manatees in locations as far offshore as the Dry Tortugas Islands, approximately 50 mi. (81 km) west of Key West, Florida, manatees rarely venture into deep ocean waters.

Migration Patterns

The overall geographic distribution of manatees within Florida has changed since the 1950s and 60s (Lefebvre et al 1989), and prominent shifts in seasonal distribution are also evident. Specifically, the introduction of power plants and paper mills in Texas, Louisiana, southern Georgia, and northern Florida has given manatees the opportunity to expand their winter range to areas not previously frequented (Hartman 1979). Florida manatees move into warmer waters when the water temperature drops below about 68 ºF (20 ºC). Before warm effluents from power plants became available in the early 1950s, the winter range of the manatee in Florida was most likely limited on its northern bounds by the Sebastian River on the east coast and Charlotte Harbor on the west coast (Moore 1951). Since that time, manatees altered their normal migration patterns, and appreciable numbers of manatees began aggregating at new sites. As new power plants became operational, more and more manatees began taking advantage of the sites even though it required traveling great distances. Among the most important of the warm-water discharges are the Florida Power and Light Company's power plants at Cape Canaveral, Fort Lauderdale, Port Everglades, Riviera Beach, and Fort Myers, and the Tampa Electric Company's Apollo Beach power plant in Tampa Bay. During cold weather, more than 200 manatees have been reported at some power plants. These anthropogenically heated aquatic habitats have allowed manatees to remain north of their historic wintering grounds. Although seemingly conducive for survival, warm-water industrial discharges alone cannot furnish suitable habitats for manatees, as they may not be associated with forage that is typically found near natural warm-water refugia of natural springs.

Population Trends

Determining exact population estimates or trends is difficult for this species. The best indicator of population trends is derived from mortality data and aerial surveys (Ackerman et al. 1992, Ackerman et al. 1995, Lefebvre et al. 1995). Increases in the number of recovered dead manatees have been interpreted as evidence of increasing mortality rates (Ackerman et al. 1992, Ackerman et al. 1995). Because manatees have low reproductive rates, these increases in mortality may lead to a decline in the population (O'Shea et al. 1988, 1992). Aerial surveys, which represent the minimum number of manatees in Florida waters (not the total population size), have been conducted for more than 20 years, and may indicate population growth. However, because survey methods were inconsistent, conclusions are tentative. O'Shea (1988) found no firm evidence of a decrease or increase between the 1970s and 1980s, even though aerial survey counts increased. Over the last decade, aerial counts have varied from 1,267 (in 1991) to 3,276 (in 2001) (FMRI 2002). The mean number observed during all counts (January, February, and/or March of all years since 1991) is 2,027 (std dev = 512).

Mortality

Human activities have likely affected manatees by eliminating or modifying suitable habitat; causing alteration of, or limiting access to historic migratory routes; and killing or injuring individuals through incidental or negligent activities. To understand manatee mortality trends in Florida, Ackerman et al. (1995) evaluated the number of recovered carcasses between 1974 and 1992 and categorized the causes of death. The number of manatees killed in collisions with watercraft increased each year by 9.3%. The number of manatees killed in collisions with watercraft each year correlated with the total number of pleasure and commercial watercraft registered in Florida (Ackerman et al. 1995). Other deaths or injuries were incurred due to flood-control structures and navigational locks, entanglement in fishing line, entrapment in culverts, and poaching, which together accounted for 162 known mortalities between 1974 and 1993 (FMRI 2002a).

Table 2 Manatee deaths in Florida (statewide) from 1974 through 2001 (source: FMRI)

Year	Watercraft	Flood Gate/ Canal Lock	Other Human	Perinatal	Cold Stress	Natural	Undetermined	Unrecovered	Total
1974	3	0	2	0	0	0	2	0	7
1975	6	1	1	7	0	1	10	3	29
1976	10	4	0	14	0	2	22	10	62
1977	13	6	5	9	0	1	64	16	114
1978	21	9	1	10	0	3	34	6	84
1979	24	8	9	9	0	4	18	5	77
1980	16	8	2	13	0	5	15	4	63
1981	24	2	4	13	0	9	62	2	116
1982	20	3	1	14	0	41	29	6	114
1983	15	7	5	18	0	6	28	2	81
1984	34	3	1	25	0	24	40	1	128
1985	33	3	3	23	0	19	32	6	119
1986	33	3	1	27	12	1	39	6	122
1987	39	5	2	30	6	10	22	0	114
1988	43	7	4	30	9	15	23	2	133
1989	50	3	5	38	14	18	39	1	168
1990	47	3	4	44	46	21	40	1	206
1991	53	9	6	53	1	13	39	0	174
1992	38	5	6	48	0	20	45	1	163
1993	35	5	6	39	2	22	34	2	145
1994	49	16	5	46	4	33	37	3	193
1995	42	8	5	56	0	35	53	2	201
1996	60	10	0	61	17	101	154	12	415
1997	54	8	8	61	4	42	61	4	242
1998	66	9	6	53	9	12	72	4	231
1999	82	15	8	53	5	37	69	0	269
2000	78	8	8	58	14	37	62	8	273
2001	81	1	7	61	32	33	108	2	325

Of interest is the increase in the number of perinatal deaths. The frequency of perinatal deaths (stillborn and newborn calves) has been consistently high over the past 5 years. The cause of the increase in perinatal deaths is uncertain, but may result from a combination of factors that includes pollution, disease, or environmental change (Marine Mammal Commission 1992). It may also result from the increase in collisions between manatees and watercraft because some newborn calves may die when their mothers are killed or seriously injured by boat collisions, when they become separated from their mothers while dodging boat traffic, or when stress from vessel noise or traffic induces premature births (Marine Mammal Commission 1992).

The greatest present threat to manatees is the high rate of manatee mortalities caused by watercraft collisions. Between 1974 and 1997, there were 3,270 known manatee mortalities in Florida. Of these, 749 were watercraft-related. Since 1974, an average of 31 manatees have died from watercraft-related injuries each year. Between 1983 and 1993, manatee mortalities resulting from collisions with watercraft reached record levels (DEP 1994). Between 1986 and 1992, watercraft collisions accounted for 37.3% of all manatee deaths where the cause of death could be determined (Ackerman *et al.* 1995).

The significance of manatee mortalities related to watercraft appears to be the result of dramatic increases in vessel traffic (O'Shea et al. 1985). Ackerman *et al.* (1995) showed a strong correlation between the increase in recorded manatee mortality and increasing boat registrations. In 1960, there were approximately 100,000 registered boats in Florida; by 1990, there were more than 700,000 registered vessels in Florida (Marine Mammal Commission 1992, Wright *et al.* 1995). Approximately 97 percent of these boats are registered for recreational use. The most abundant number of registered boats is in the 16-foot to 26-foot size class. Watercraft-related mortalities were most significant in the southwest and northeast regions of Florida; deaths from watercraft increased from 11 to 25 percent in southwestern Florida. In all of the counties that had high watercraft-related manatee deaths, high numbers of watercraft were combined with high seasonal abundance of manatees (Ackerman *et al.* 1995).

Approximately twice as many manatees died from impacts suffered during collisions with watercraft than from propeller cuts; this has been a consistent trend over the last several years. Medium or large-sized boats cause most lethal propeller wounds, while impact injuries are caused by fast, small to medium-sized boats (Wright *et al.* 1992). The Florida Marine Research Institute (FMIR) conducts carcass recovery and necropsy activities throughout the state to attempt to assess the cause of death for each carcass recovered.

Designated Critical Habitat for Species Included in this Assessment

American Crocodile *(Crocodylus acutus)*

There have been at least two observations of crocodiles at or near Virginia Key (FWC, pers com; Mazzotti, pers com), however designated critical habitat for this species does not include the island (U.S. Fish and Wildlife Service 1999). Crocodiles are more frequently observed in Bill Baggs/Cape Florida State Park on Key Biscayne (G. Milano, Department of Environmental Resource Management-Dade County, 2002).

Florida Manatee *(Trichecus manatus)*

Critical habitat was designated for the manatee in 1976, although no specific primary or secondary constituent elements were included in the designation (50 CFR 17.95). Critical habitat for the manatee identifies specific areas occupied by the manatee, which have those physical or biological features essential to the conservation of the manatee and/or may require special management considerations.

Project Area Specific Information for Species Included in this Assessment

American Crocodile *(Crocodylus acutus)*

Local Distribution and Status

The current distribution of the American crocodile is limited to extreme South Florida, including coastal areas of Miami-Dade, Monroe, Collier, and Lee counties. In Biscayne Bay, crocodiles have been observed as far north as Crandon Park, Bill Baggs Cape Florida SRA, and Snapper Creek (FWS, 1999). Occasional sightings are still reported farther north on the east coast, and there are also records from Broward County, along the entire length of Biscayne Bay; a few isolated crocodiles still survive in remnant mangrove habitats there.

While there are no published records specifically citing American crocodiles utilizing the waters of the Port of Miami, it is possible that they utilize the waters of the Bill Sadowski Critical Wildlife Area north of Virginia Key for foraging. Crocodiles have been recorded in the vicinity of Virginia Key and nesting on Key Biscayne (Crandon Park Marina and Bill Baggs State Recreation Area).

Florida Manatee *(Trichecus manatus)*

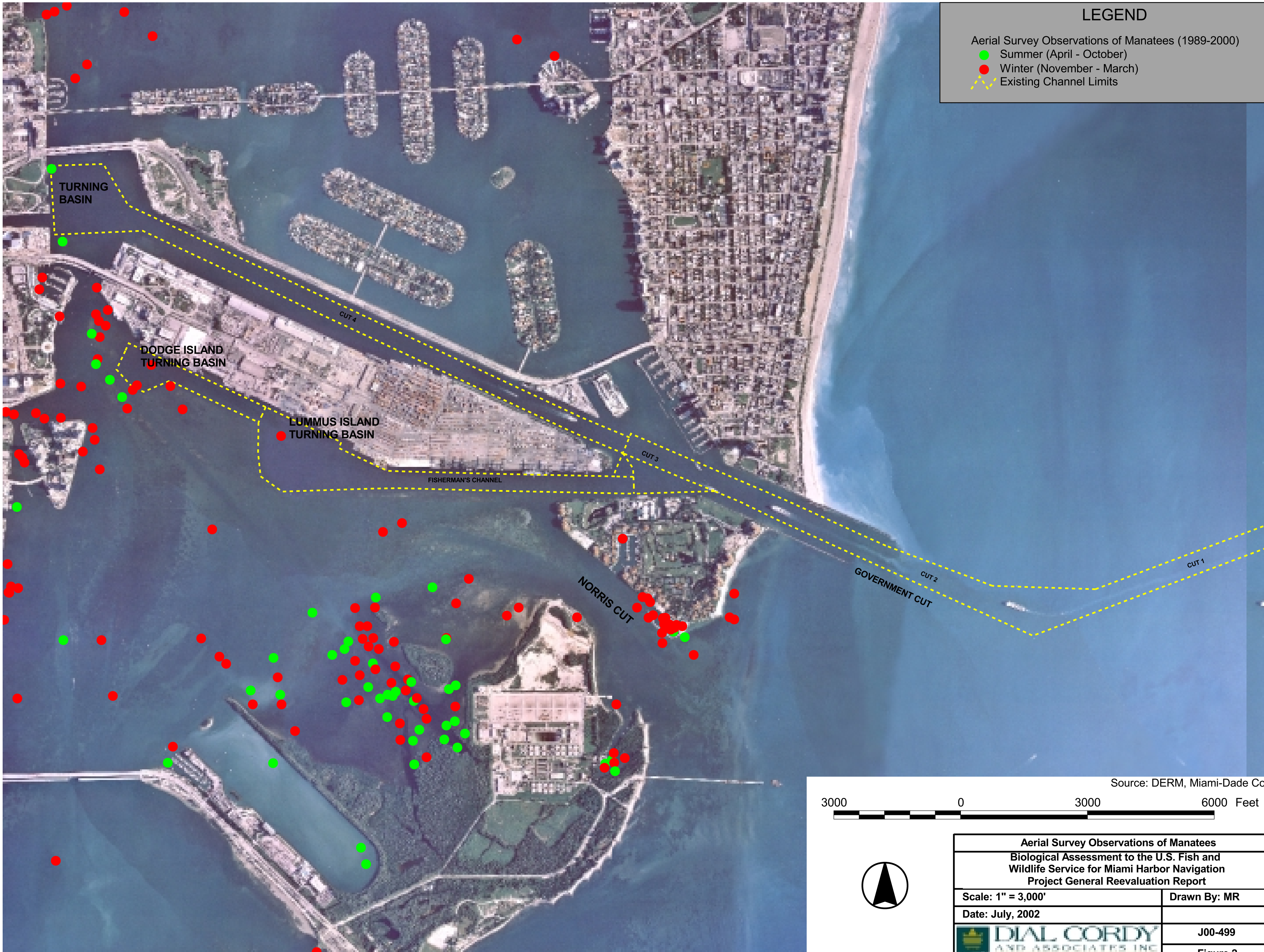
Local Distribution and Status

Historical records regarding manatees in South Florida are sparse. Manatees are mentioned in documents that are dated as early as the mid 1800's and early 1900's (O'Shea 1988). Moore (1951) indicated that manatees commonly used the New River and the Miami River. He also noted a 1943 anecdotal observation of more than 100 manatees killed during the deepening of the Miami River Channel and a reference to 195 manatees aggregating at the Miami power plant discharge in 1956 (Mezich 2001). In general, the rivers, creeks and canals that open into Northern Biscayne Bay were locations noted for their manatee abundance. These remain important habitats, particularly on a seasonal basis (Figures 2 and 3). In freshwater environments in Dade County (upper reaches of canals), manatees are feeding primarily on the exotic *Hydrilla verticillata*. During cooler weather, manatees feed on extensive meadows of seagrasses in many parts of Biscayne Bay.

Local Mortality

The causes for manatee deaths in Dade County are varied (Table 3; Figure 4). The highest number of manatee deaths in Dade County result from water control structures. Floodgates often have qualities that are attractive to manatees. Freshwater is often available at floodgates, and is typically slightly warmer the ambient water. An example of this situation is the floodgate on the Little River in Dade County. This site is known to attract manatees in winter during mild weather. This location has a 1-degree Celsius higher water temperature than surrounding areas and freshwater is available (Deutsch 2000). Also, freshwater vegetation is often washed down from upriver and made available when the gates are opened. Figure 5 demonstrates the location of water control structures near the project area. The second most frequent cause of manatee deaths in Miami-Dade County is boat-related injuries.

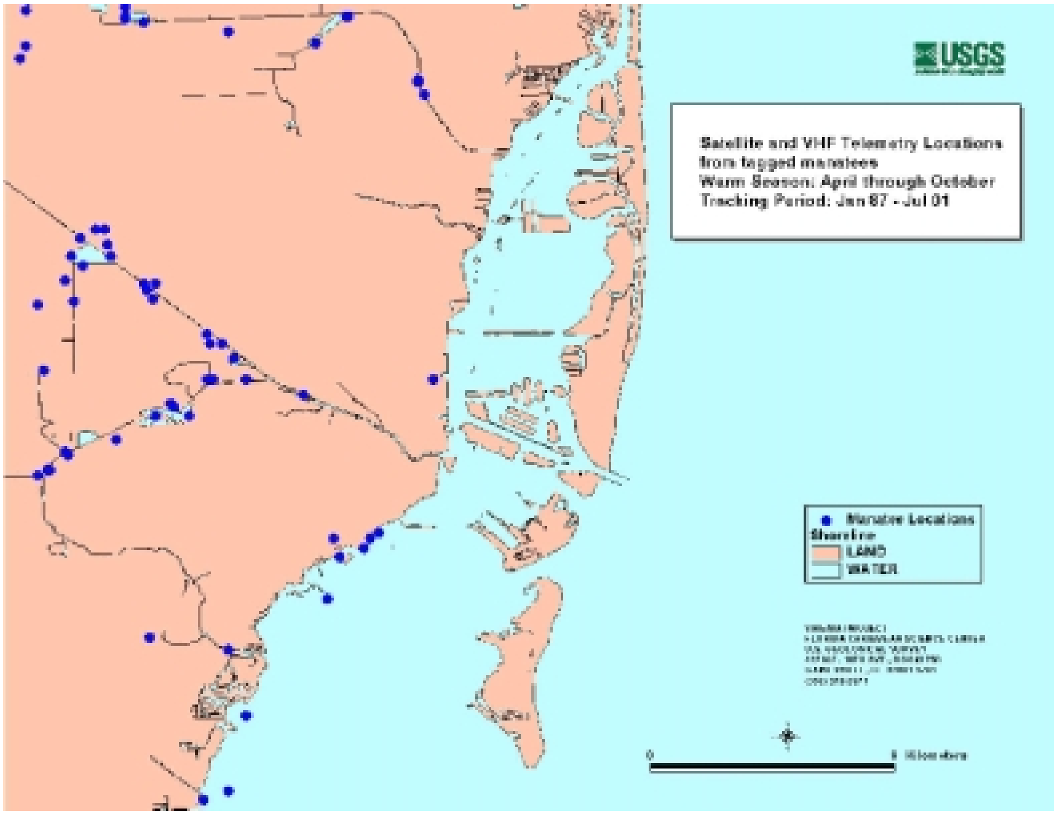
No deaths related to cold stress have been reported. Miami Harbor is well within the historic range for the Florida manatee described by Moore (1951), and therefore water temperatures likely seldom reach stressing levels for extended periods of time. Also, power plants located to the north in Broward County have likely ameliorated cold-related stress.

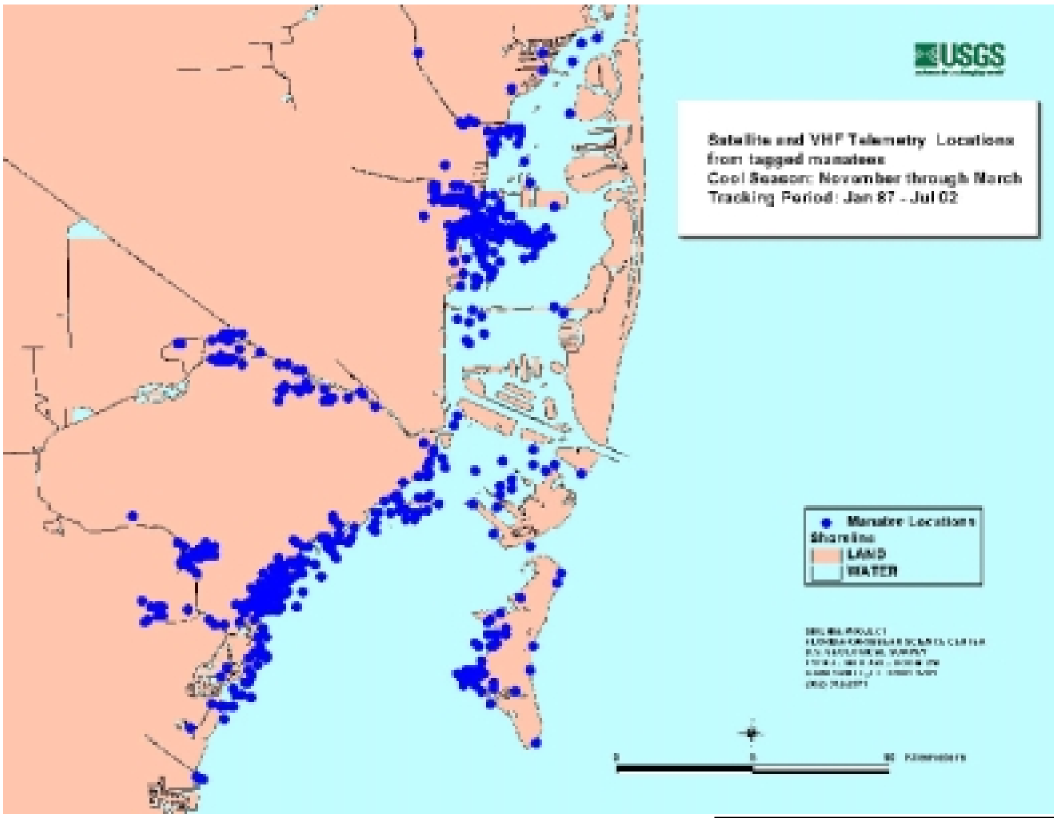


Aerial Survey Observations of Manatees

Biological Assessment to the U.S. Fish and Wildlife Service for Miami Harbor Navigation Project General Reevaluation Report

Scale: 1" = 3,000'	Drawn By: MR
Date: July, 2002	
DIAL CORDY AND ASSOCIATES INC	J00-499
	Figure 2





Manatee Locations Based on Telemetry	
Biological Assessment to the U.S. Fish and Wildlife Service for Miami Harbor Navigation Project General Reevaluation Report	
Scale: 1" = 3,000'	Drawn By: MR
Date: July, 2002	
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J00-499
	Figure 3

Source: USGS

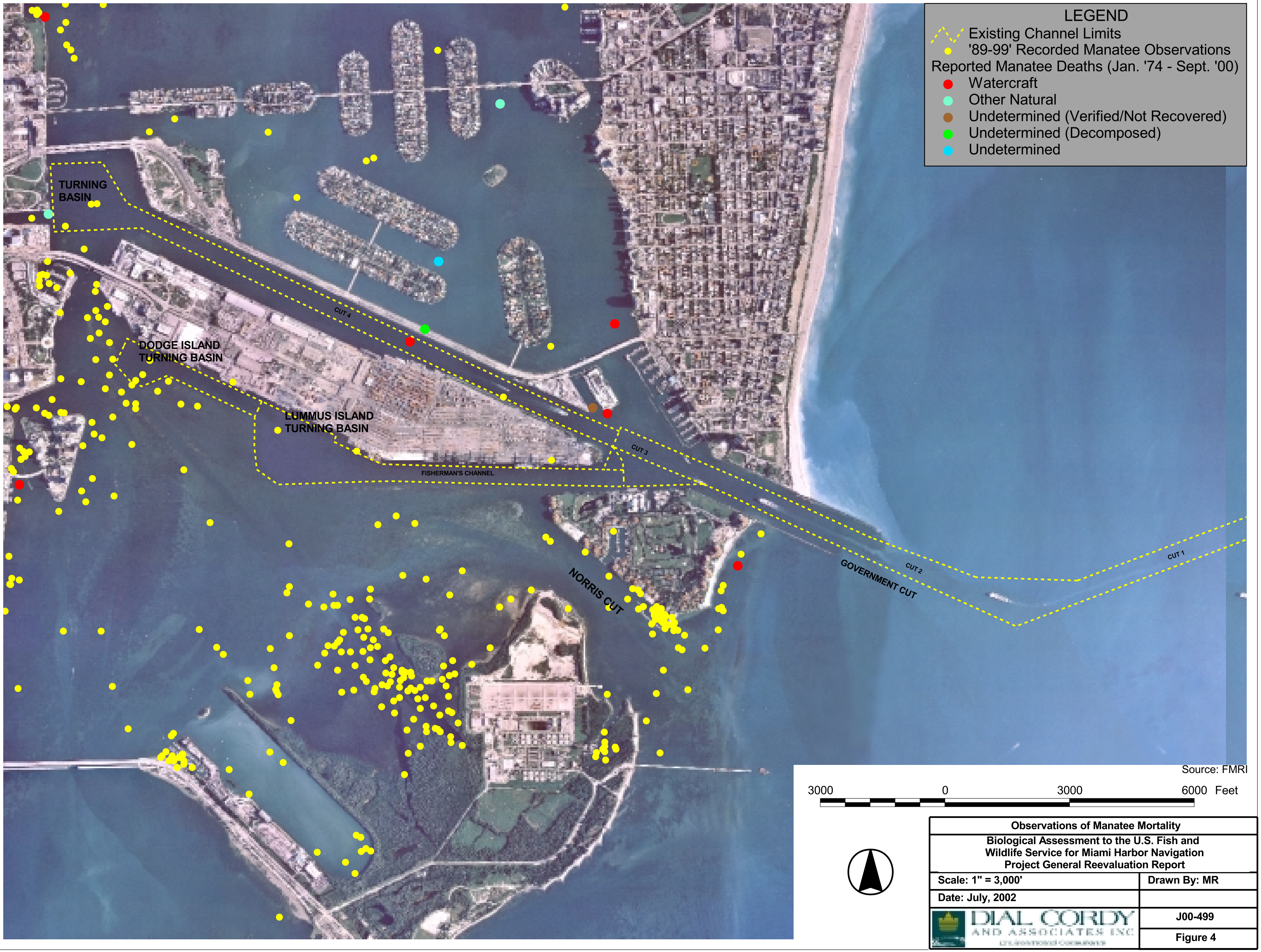

LEGEND
Existing Channel Limits
'89-99' Recorded Manatee Observations
Reported Manatee Deaths (Jan. '74 - Sept. '00)
Watercraft
Other Natural
Undetermined (Verified/Not Recovered)
Undetermined (Decomposed)
Undetermined
TURNING BASIN
DODGE ISLAND TURNING BASIN
LUMMUS ISLAND TURNING BASIN
CUT 4
CUT 3
CUT 2
CUT 1
FISHERMAN'S CHANNEL
NORRIS CUT
GOVERNMENT CUT
Source: FMRI
3000 0 3000 6000 Feet
Observations of Manatee Mortality
Biological Assessment to the U.S. Fish and Wildlife Service for Miami Harbor Navigation Project General Reevaluation Report
Scale: 1" = 3,000'
Drawn By: MR
Date: July, 2002
DIAL CORDY AND ASSOCIATES INC
J00-499
Figure 4

Figure #5 – Location of Water Control Structures in Miami-Dade County

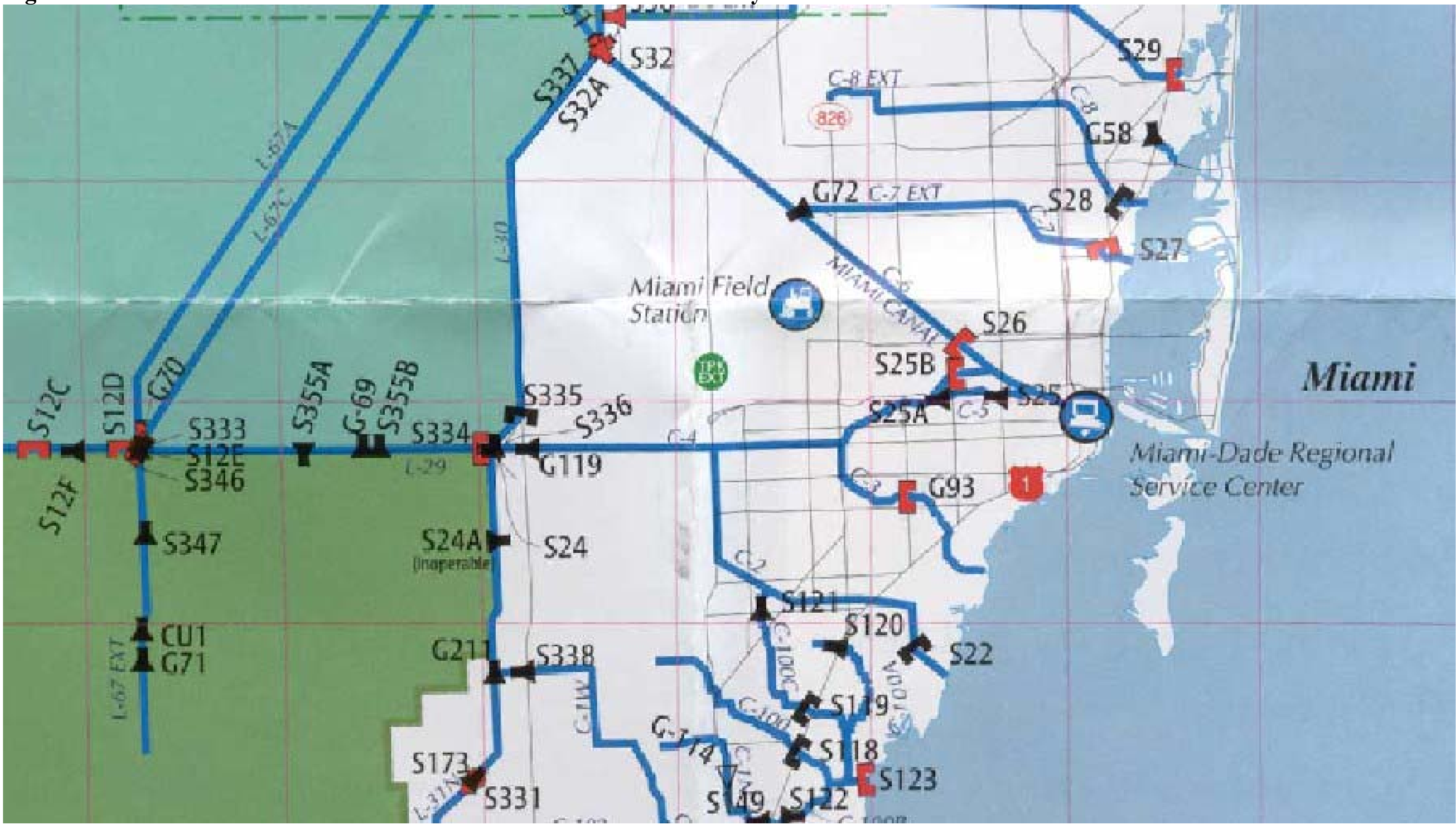


Table #3 Manatee deaths in Miami-Dade County from 1974 through 2001 (source: FMRI)

Year	Watercraft	Gate/Lock	Human, Other	Perinatal	Cold stress	Natural	Undetermined	Total
1974	2	0	0	0	0	0	0	2
1975	1	1	0	1	0	0	1	4
1976	2	4	0	0	0	1	8	15
1977	1	5	2	2	0	0	2	12
1978	2	8	0	0	0	0	2	12
1979	1	5	2	0	0	0	1	9
1980	0	2	0	0	0	0	0	2
1981	1	0	2	0	0	0	2	5
1982	0	2	0	0	0	0	2	4
1983	0	1	4	1	0	0	1	7
1984	1	0	0	0	0	0	0	1
1985	1	1	0	2	0	0	0	4
1986	1	0	1	0	0	0	0	2
1987	4	2	0	1	0	0	1	8
1988	1	6	0	0	0	1	1	9
1989	3	0	0	0	0	0	0	3
1990	1	1	0	0	0	0	2	4
1991	0	1	0	2	0	2	2	7
1992	4	1	1	1	0	1	2	10
1993	0	2	2	0	0	0	1	5
1994	1	4	3	1	0	1	1	11
1995	2	3	2	0	0	3	4	14
1996	0	3	0	1	0	0	3	7
1997	5	5	1	2	0	0	1	14
1998	2	3	1	0	0	0	3	9
1999	1	5	3	0	0	2	1	12
2000	2	2	2	0	0	0	2	8
2001	5	0	2	2	0	0	2	11
Totals	26	30	17	9	0	9	24	115

Protective Measures Taken in the Project Area Separate from Conservation Measures the Corps will Undertake as Part of the Proposed Action

Miami-Dade County

Miami-Dade County is one of 13 Florida counties required to have a manatee protection plan (MPP) developed under the Local Government Comprehensive Planning and Land Development Regulation Act (LGCPALDRA) of 1985. The LGCPALDRA requires these plans include speed and no entry zones, boat facility siting policies and other measures to protect manatees. Miami-Dade County has prepared a plan, submitted it to the State, through the Florida Fish and Wildlife Conservation Commission, and to the Federal government through the US Fish and Wildlife Service. As of November 2001, both the state nor the USFWS had approved the Miami-Dade County plan (USFWS 2001). The following discussions of speed zones, boat facility siting policies and other protective measures are taken directly from the Miami-Dade Manatee Protection Plan (Dade County, 1995).

Speed & No Entry Zones

In 1979, the Florida Department of Natural Resources designated the Black Creek area including Black Point Marina (south of the project area) as a manatee sanctuary. The "Idle Speed No

Wake" zone associated with this sanctuary extends from the Black Creek enterance channel in Biscayne Bay to the salinity control structure on Black Creek and Goulds Canal, and includes all tidal canals in the vicinity. Prior to late 1991, there were no other speed zones in Dade County established for manatee protection, although several other areas were regulated for boating safety. In November 1991, the Florida Governor and Cabinet approved a state rule establishing many additional vessel speed restrictions for manatee protection. Figure 6 denotes all current speed zones and manatee protection areas in Dade County.

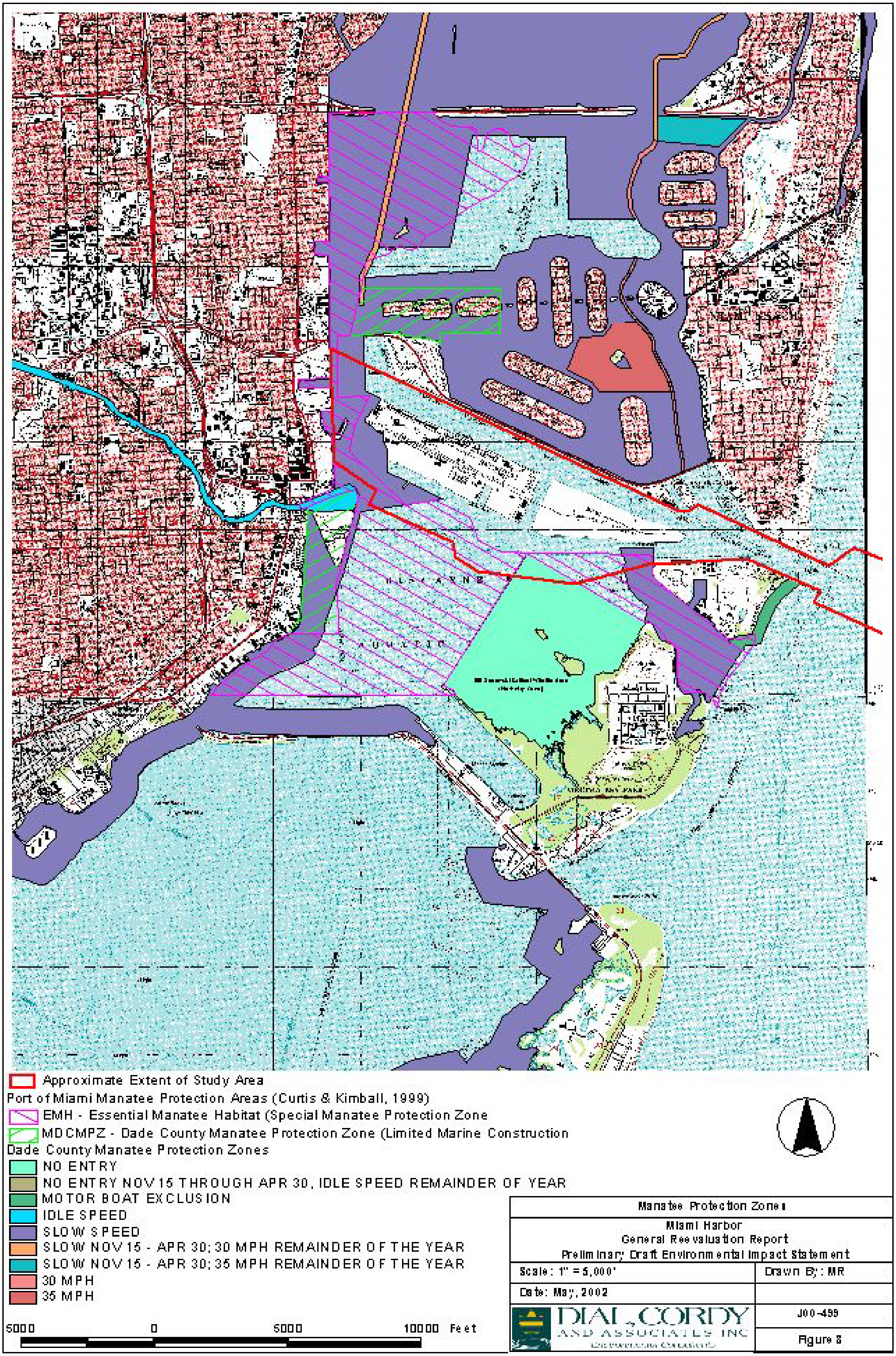
Boating facility Siting Policies
The LGCPALDRA requires "manatee" counties to prepare policies concerning the siting of boating facilities. Dade County has include Marine Facility Siting Criteria in their MPP.

Designation of Essential Habitat for Manatees within the County
Dade County has identified areas to be designated as essential habitat: seagrass beds – specifically those in Dumfoundling Bay and Biscayne Bay between the 79th Street and the Julia Tuttle causeways, between the Port of Miami and Rickenbacker Causeway, in the Chicken Key area and in the area of the Black Creek channel. Additional habitat areas listed for protection under the Dade County MPP include sources of freshwater; warm water refuges (although none currently operate in the boundaries of Dade county); aggregation areas (including Sky Lake, Biscayne Canal near the Miami Shores Country Club golf course, Little River west of Biscayne Boulevard, northwest Virginia Key, upstream Miami River including Palmer Lake, upstream Coral Gables Waterway, and Black Point marina basin) and manatee travel corridors.

Scientific Research on Manatees
Regulations developed under the ESA allow for the taking of ESA-listed manatees for the purposes of scientific research. In addition, the ESA also allows for the taking of listed species by states through cooperative agreements developed per section 6 of the ESA. Prior to issuance of these authorizations for taking, the proposal must be reviewed for compliance with section 7 of the ESA. Permits to conduct scientific research on manatees are issued by the FWS' headquarters in Arlington, Virginia (Jim Valade, USFWS – Jacksonville, 2002 pers.com). Research activities currently conducted under permit from FWS in the action area include:

- Photo identification study of manatees by the USGS-Sirenia project.
- Carcass recovery and necropsy activities conducted by the State of Florida through the Florida Marine Research Institute's Marine Mammal Pathology Laboratory.

Other consultations of Federal actions in the area to date
The Corps has been working with the citizens of Dade County since 1902 on improving and maintaining the Port of Miami (USACE 2002). The following table lists the improvements authorized by Congress. None of the projects authorized by Congress through 1968 were required to consult under the ESA.


Approximate Extent of Study Area
Port of Miami Manatee Protection Areas (Curtis & Kimball, 1999)
EMH - Essential Manatee Habitat (Special Manatee Protection Zone
MDCMPZ - Dade County Manatee Protection Zone (Limited Marine Construction
Dade County Manatee Protection Zones
NO ENTRY
NO ENTRY NOV 15 THROUGH APR 30, IDLE SPEED REMAINDER OF YEAR
MOTOR BOAT EXCLUSION
IDLE SPEED
SLOW SPEED
SLOW NOV 15 - APR 30; 30 MPH REMAINDER OF THE YEAR
SLOW NOV 15 - APR 30; 35 MPH REMAINDER OF THE YEAR
30 MPH
35 MPH
5000 0 5000 10000 Feet
Manatee Protection Zones
Miami Harbor
General Reevaluation Report
Preliminary Draft Environmental Impact Statement
Scale: 1" = 5,000'
Drawn By: MR
Date: May, 2002
DIAL CORDY AND ASSOCIATES INC
J00-499
Figure 8

ACTS	WORK AUTHORIZED	DOCUMENTS
13 June 1902	Channel (Government Cut) 18 feet deep across peninsula and north jetty	H. Doc.662/56/1 & A.R. for 1900 p.1987
2 Mar 1907	South Jetty and channel 100 feet wide.	Specified in Act
25 June 1912	Channel 20 feet deep by 300 feet wide and extension of jetties.	H. Doc. 554/62/2
3 Mar 1925	Channel 25 feet deep at entrance and 25 feet deep by 200 feet across Biscayne Bay	H. Doc. 516/67/4
3 Jul 1930	Channel 300 feet wide across Biscayne Bay and enlarging municipal turning basin.	R&H Comm. Doc. 15/71/2
30 Aug 1935	Depth of 30 feet to and in turning basin.	S. Comm. Print 73.2
26 Aug 1937	Widen turning basin 200 feet on south side.	R&H. C. Doc. 86/74/2
2 Mar 1945	Virginia Key Improvement (De-authorized)	S. Doc. 251/79/2
2 Mar 1945	Consolidation of Miami River and Miami Harbor projects; widening at mouth of Miami River (De-authorized); a channel from the mouth of the river to the Intracoastal Waterway (De-authorized); thence a channel from the Intracoastal Waterway to Government Cut (De-authorized); and a channel from Miami River to harbor of refuse in Palmer Lake (De-authorized).	H. Doc. 91/79/1
14 Jul 1960	Channel 400 feet wide across Biscayne Bay; enlarge turning basin 300 feet on south and northeasterly sides; dredge turning basin on north side Fisher Island; de-authorize Virginia Key development.	S. Doc. 71/85/2
13 Aug 1968	Enlarging the existing entrance channel to 38-foot depth and 500-foot width from the ocean to the existing beach line; deepening the existing 400-foot wide channel across Biscayne Bay to 36 feet; and deepening the existing turning basin at Biscayne Boulevard terminal and Fisher Island to 36 feet.	S. Doc. 93/90/2
17 Nov 1986	De-authorized the widening at the mouth of Miami River to existing project widths; and the channels from the mouth of Miami River to the turning basin, to Government Cut, and to a harbor of refuge in Palmer Lake.	Public Law 99-662
28 Nov 1990	Deepening the existing Outer Bar Cut, Bar Cut, and Govt Cut to a depth of 44 ft.; Enlarging Fishermans Channel, south of Lummus Island, to a depth of 42 ft. and a width of 400 ft.; and Constructing a 1600 ft. diameter Turning Basin near the west end of Lummus Island to a depth of 42 ft.	Public Law 101-640 11/28/90

The Corps is also working with Miami-Dade County on an environmental restoration project on Virginia Key, located to the south of the Port. The FWS issued a biological opinion on the proposed Virginia Key project on May 17, 2002 stating "… the Service anticipates that the responses of sea turtles to the proposed action will be minimal, or positive."

Another action, the Lummus Island Turning Basin deepening project, is a project with similar risks as the proposed project, but on a much smaller scale (only one inshore dredge area) and includes precautions similar to those proposed for the Miami Harbor deepening/widening project. The Corps re-initiated consultation with FWS on March 25, 2002 and the Service concluded consultation with the Corps on the project on June 19, 2002 concurring with the Corps finding that the Lummus Island Turning Basin deepening may affect, but will not adversely affect listed species under FWS jurisdiction in the action area.

Effects of the Proposed Action

Direct Effects

The highest potential to directly effect manatees and crocodiles may be the use of explosives to remove areas of rock within channels. Both the pressure and noise associated with blasting can injure or kill marine organisms, depending on the distance from the discharge (Keevin and Hempen, 1997).

American Crocodile

To date, there has not been a single comprehensive study to determine the effects of underwater explosions on reptiles that defines the relationship between distance/pressure and mortality or damage (Keevin and Hempen, 1997). However, there have been studies, which demonstrate that sea turtles are killed and injured by underwater explosions (Keevin and Hempen, 1997). Crocodiles are shy, un-aggressive animals, and as such, the Corps believes that it is very unlikely that a crocodile will be seen in or near the project area during construction. However, due to the proximity of areas of recorded sightings of crocodiles, we are including the American crocodile in the assessment of effects. Crocodiles possess integumentary sensory organs (ISO). At this time, there is little information documented about the purpose of these organs, however, some research has hinted that the purpose of these ISOs includes detecting pressure changes, sensory role in detecting underwater prey and possibly in detecting changes in salinity. The Corps plans to protect crocodiles in the same manner as manatees and other listed and protected species in the action area. Details concerning our protection methods are provided below.

Florida Manatee

The effects of noise and pressure on manatees, associated with confined underwater blasting have not been documented. After discussions with Dr. Darlene Kettin of the Woods-Hole Oceanographic Institute, the Corps has determined that manatees would be impacted similar to dolphins, for which some published data do exist.

Blasting

To achieve the deepening of the Port of Miami from the existing depth of -42 feet to project depth of -50 feet, pretreatment of the rock areas may be required. Blasting is anticipated to be required for some or all of the deepening of the channel inside of the entrance jetties, where standard construction methods are unsuccessful. The total volume to be removed in these areas is up to 2.3 million cubic yards. The work may be completed in the following manner:

Contour dredging with either bucket, hydraulic or excavator dredges to remove material that can be dredged conventionally and determine what areas require blasting.

Pre-treating (blasting) the remaining above grade rock, drilling and blasting the "Site Specific" areas where rock could not be conventionally removed by the dredges.

Excavating with bucket, hydraulic or excavator dredges to remove the pre-treated rock areas to grade.

All drilling and blasting will be conducted in strict accordance with local, state and federal safety procedures. Marine Wildlife Protection, Protection of Existing Structures, and Blasting Programs coordinated with federal and state agencies.

Based upon industry standards and USACE, Safety & Health Regulations, the blasting program may consist of the following:

The weight of explosives to be used in each blast will be limited to the lowest poundage (~90 lbs. or less) of explosives that can adequately break the rock. The blasting would consist of up to 3 blasts per day, preparing for removal of approximately 1500 cubic yards per blast. This equates to about 520 blast days to complete the project (based on an assumption of one drillboat, and assuming that the entire project area inside the jetties will require blasting).

The following safety conditions are standard in conducting underwater blasting:

- Drill patterns are restricted to a minimum of 8 ft separation from a loaded hole.
- Hours of blasting are restricted from 2 hours after sunrise to 1 hour before sunset to allow for adequate observation of the project area for protected species.
- Selection of explosive products and their practical application method must address vibration and air blast (overpressure) control for protection of existing structures and marine wildlife.
- Loaded blast holes will be individually delayed to reduce the maximum pounds per delay at point detonation, which in turn will reduce the mortality radius.
- The blast design will consider matching the energy in the “work effort” of the borehole to the rock mass or target for minimizing excess energy vented into the water column or hydraulic shock.

Because of the potential duration of the blasting and the proximity of the blasting to a Critical Wildlife Area, a number of issues will need to be addressed. One of the key issues is the extent of a safety radius for the protection of marine wildlife. This is the distance from the blast site which any protected species must be in order to commence blasting operations. Ideally the safety radius is large enough to offer a wide buffer of protection for marine animals while still remaining small enough that the area can be intensely surveyed

There are a number of methods that can be used to calculate a safety radius. Little published data exists for actual measurements of sub aqueous blasts confined to a rock layer and their impacts to marine mammals or turtles. There is some information on the impacts to fish from similar blasts. Both literature searches and actual observations from similar blasting events will be used as a guide in establishing a safety radius that affords the best protection from lethal harm to marine wildlife. The following will be considered in establishing the radius:

The U.S. Navy Dive Manual and the FFWCC Endangered Species Watch Manual the safety formula for an uncontrolled blast suspended in the water column, which is as follows:

R = 260 (cube root w)
R = Safety radius
W = Weight of explosives

This formula is a conservative for the blasting being done in the Port of Miami since the blast will be confined within the rock and not suspended in the water column.

The FFWCC Endangered Species Watch Manual designation that an extra 1000 ft buffer is required to afford animals an added measure of safety.

Utilizing data from rock-contained blasts such as those at Atlantic Dry Dock and Wilmington, North Carolina, the Corps has been able to estimate potential effects on protected species. These data can be correlated to the biological opinion issued on October 10, 2000 by NMFS for the incidental taking of listed marine mammals for the explosive shock testing of the USS Winston Churchill (DDG-81) (66 FR 22450) concerning blasting impacts to marine mammals. The data references in the Federal Register data indicates that impacts from explosives can produce lethal and non-lethal injury as well as incidental harassment. The pressure wave from the blast is the most causative factor in injuries because it affects the air cavities in the lungs & intestines. The extent of lethal effects are proportional to the animal's mass, i.e., the smaller the animal, the more lethal the effects; therefore all data is based on the lowest possible affected mammal weight (infant dolphin). Non- lethal injuries include tympanic membrane (TM) rupture; however, given that dolphin & manatee behavior rely heavily on sound, the non-lethal nature of such an injury is questionable in the long-term. For that reason, it is important to use a limit where no non-lethal (TM) damage occurs. Based on the EPA test data, the level of pressure impulse where no lethal and no non-lethal injuries occur is reported to be five (5) psi-msec.

The degradation of the pressure wave
George Young (1991) noted the following limitations of the cube root method:

> *Doubling the weight of an explosive charge does not double the effects. Phenomena at a distance, such as the direct shock wave, scale according to the cube root of the charge weight. For example, if the peak pressure in the underwater shock wave from a 1-pound explosion is 1000 pounds per square inch at a distance of 15 feet, it is necessary to increase the charge weight to approximately 8 pounds in order to double the peak pressure at the same distance. (The cube root of eight is two.)*

Effects on marine life are usually caused by the shock wave. At close-in distances, cube root scaling is generally valid. For example, the range at which lobster have 90 percent survivability is 86 feet from a 100-pound charge and double that range (172 feet) from an 800-pound charge.

As the wave travels through the water, it reflects repeatedly from the surface and seabed and loses energy becoming a relatively weak pressure pulse. At distances of a few miles, it resembles a brief acoustic signal. Therefore, shock wave effects at a distance may not follow simple cube root scaling but may decline at a faster rate. For example, the survival of swim bladder fish does not obey cube root scaling because it depends on the interaction of both the direct and reflected shock waves. In some cases, cube root scaling may be used to provide an upper limit in the absence of data for a specific effect.

More recent studies by Finneran *et. al*. (2000), showing that temporary and permanent auditory threshold shifts in marine mammals were used to evaluate explosion impacts. Due to the fact that marine mammals are highly acoustic, such impacts in behavior should be taken into account when assessing harmful impacts. While many of these impacts are not lethal and this study has shown that the impacts tend not to be cumulative, significant changes in behavior could constitute a “take” under the Marine Mammal Protection Act (MMPA).

A dual criteria for marine mammal acoustic harassment has also been developed for explosive-generated signals. Noise levels that fall between the 5 psi-msec to a distance where a noise level of 180 dB (3 psi), while outside any physical damage range, can be considered to fall within the incidental harassment zone.

Conservation Measures

<u>Construction</u>

The Corps will incorporate the standard manatee protection construction conditions into our plans and specifications for this project. These standard conditions are:

1. The contractor instructs all personnel associated with the project of the potential presence of manatees and the need to avoid collisions with manatees. All construction personnel are responsible for observing water-related activities for the presence of manatee(s), and shall implement appropriate precautions to ensure protection of the manatee(s).

2. All construction personnel are advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and the Florida Manatee Sanctuary Act. The permittee and/or contractor may be held responsible for any manatee harmed, harassed, or killed as a result of construction activities.

3. <u>Prior</u> to commencement of construction, the prime contractor involved in the construction activities shall construct and display at least two temporary signs (placard) concerning manatees. For all vessels, a temporary sign (at least 8 1/2" x 11") reading "Manatee Habitat/Idle Speed In Construction Area" will be placed in a prominent location visible to

employees operating the vessels. In the absence of a vessel, a temporary sign (at least 2' x 2') reading "Warning: Manatee Habitat" will be posted in a location prominently visible to land based, water-related construction crews.

A second temporary sign (at least 8 1/2" x 11") reading "Warning, Manatee Habitat: Operation of any equipment closer than 50 feet to a manatee shall necessitate immediate shutdown of that equipment. Any collision with and/or injury to a manatee shall be reported immediately to the Florida Marine Patrol at 1-800-DIAL-FMP" will be located prominently adjacent to the displayed issued construction permit. Temporary notices are to be removed by the permittee upon completion of construction.

4. Siltation barriers are properly secured so that manatees cannot become entangled, and are monitored at least daily to avoid manatee entrapment. Barriers must not block manatee entry to or exit from essential habitat.
5. All vessels associated with the project operate at "idle speed/no wake" at all times while in the construction area and while in waters where the draft of the vessel provides less than a four foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

6. If manatees are seen within 100 yards of the active daily construction/dredging operation, all appropriate precautions shall be implemented to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 feet of a manatee. Operation of any equipment closer than 50 feet to a manatee shall necessitate immediate shutdown of that equipment.

7. Any collision with and/or injury to a manatee shall be reported immediately to the Florida Marine Patrol (1-800-DIALFMP) and to the Florida Department of Protection, Office of Protected Species Management at (904)922-4330.

8. The contractor maintains a log detailing sightings, collisions, or injuries to manatees should they occur during the contract period. A report summarizing incidents and sightings shall be submitted to the Florida Department of Protection, Office of Protected Species Management, Mail Station 245, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399 and to the U.S. Fish and Wildlife Service, 3100 University Boulevard, Jacksonville, FL 32216. This report must be submitted annually or following the completion of the project if the contract period is less than a year.

Blasting

It is crucial to balance the demands of the blasting operations with the overall safety of the species. A radius that is excessively large will result in significant delays that prolong the blasting, construction, traffic and overall disturbance to the area. A radius that is too small puts the animals at too great of a risk should one go undetected by the observers and move into the blast area. Because of these factors, the goal is to establish the smallest radius possible without compromising animal safety and provide adequate observer coverage for whatever radius is agreed upon.

Aerial reconnaissance, where feasible, is critical to support the safety radius selected in addition to boat-based and land support reconnaissance. Additionally, an observer will be placed on the drill barge for the best view of the actual blast zone and to be in direct contact with the blaster in charge.

Prior to implementing a blasting program a Test Blast Program will be completed. The purpose of the Test Blast Program is to demonstrate and/or confirm the following:

- Drill Boat Capabilities and Production Rates
- Ideal Drill Pattern for Typical Boreholes
- Acceptable Rock Breakage for Excavation
- Tolerable Vibration Level Emitted
- Directional Vibration
- Calibration of the Environment

The Test Blast Program begins with a single range of individually delayed holes and progresses up to the maximum production blast intended for use. Each Test Blast is designed to establish limits of vibration and airblast overpressure, with acceptable rock breakage for excavation. The final test event simulates the maximum explosive detonation as to size, overlying water depth, charge configuration, charge separation, initiation methods, and loading conditions anticipated for the typical production blast.

The results of the Test Blast Program will be formatted in a regression analysis with other pertinent information and conclusions reached. This will be the basis for developing a completely engineered procedure for Blasting Plan. During the testing the following data will be used to develop a regression analysis:

- Distance
- Pounds Per Delay
- Peak Particle Velocities (TVL)
- Frequencies (TVL)
- Peak Vector Sum
- Air Blast, Overpressure

Other Rock Removal Options

The Corps investigated methods to remove the rock in the Port of Miami without blasting using a punchbarge. It was determined that the punchbarge, which would work for 12-hour periods, strikes the rock below approximately once every 30-seconds. This constant pounding would serve to disrupt manatee behavior in the area, as well as impact other marine animals in the area. Using the punchbarge will also extend the length of the project temporally, thus increasing any potential impacts to all fish and wildlife resources in the area.

The Corps believes that blasting is actually the least environmentally impactful method for removing the rock in the Port. Each blast will last no longer than 25 seconds in duration, and may even be as short as 2 seconds, and will be spaced out twelve hours apart. Additionally, the blasts are confined in the rock substrate. Boreholes are drilled into the rock below, the blasting charge is set and then the chain of explosives is detonated. Because the blasts are confined within the rock structure, the distance of the blast effects are reduced as compared to an unconfined blast.

Indirect effects
The regulations for interservice consultation found at 50 CFR 402 define indirect effects as "are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur". The Corps does not believe that the project will have any indirect effects on manatees or crocodiles in the action area.

Interrelated and Interdependent Effects
The regulations for interservice consultation found at 50 CFR 402 define interrelated actions as "those that are part of a larger action and depend on the larger action for their justification" and interdependent actions as "those that have no independent utility apart from the action under consideration."

The Corps does not believe that there are any interrelated actions for this proposed project; however, the recommended plan for the Port of Miami contains widening components and deepening components. As a result of the widening components of the project, larger container vessels will call at the Port of Miami. As a result of both the widening and the deepening components of the project, more tonnage will be carried per vessel call, so the total number of vessel calls may be reduced (Dawedit 2002. pers comm.). This will be an indirect benefit to the manatees and crocodiles since there will be fewer ships in the area to potentially affect them. Additionally, the wider channel will provide manatees and crocodiles more room to maneuver around incoming and outgoing vessels throughout the action area.

The Corps believes that the increase in size within the Port will not have an adverse effect on manatees in the area for three reasons:

1) Recent data shows that manatees are not using the Port itself as a primary habitat. Aerial surveys conducted between 1989-2001 show that very few manatees use the area of the Port proper. During the winter, they congregate in the BSCWA area to the south, the Miami River to the northwest, and north of the Julia Tuttle causeway to the north of the Port. Distribution of manatees in the area is also highly seasonal (Figures 2 and 3);
2) Efforts being undertaken by the port to comply with the Miami-Dade county MPP's protection provisions.
3) As previously demonstrated, fewer manatees are utilizing the general area of the Port in the summer (between April and October), so there are fewer animals in the area that could be affected by the project.

Cumulative effects
The regulations for interservice consultation found at 50 CFR 402 define cumulative effects as "those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consideration." The Corps is not aware of any future state or provate activites, not involving Federal activities

that are reasonably certain to occur within the action area.

Take Analysis

Due to the restrictions and special conditions placed in our construction specifications for construction and blasting the Corps does not anticipate any take of the endangered American crocodile or the Florida manatee.

Determination

The Corps has determined that the proposed expansion and deepening of Miami Harbor is likely to affect, but not likely to adversely affect listed species within the action area. The Corps believes that the restrictions placed on construction and blasting previously discussed in this assessment will diminish/eliminate the effect of the project on protected species within the action area.

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